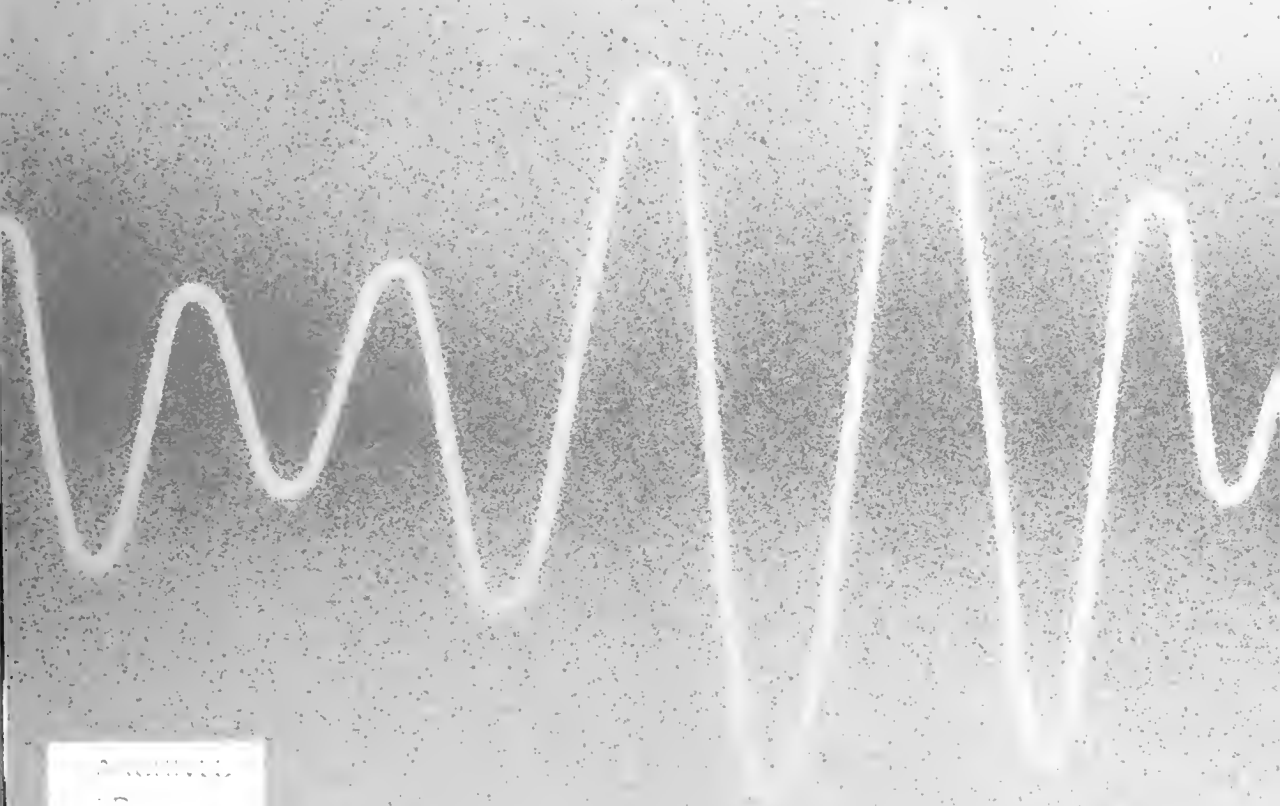
MODERN SCIENCE AND HUMAN VALUES



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MODERN SCIENCE

AND

HUMAN VALUES

A Symposium at

SWEET BRIAR COLLEGE

March, 6-8, 1958

Student delegates from other colleges register for the Symposium.

Microscope and camera reveal the intricacies of nature.

Books related to the symposium topic form a table exhibit in the Library.

A SYNOPSIS of the SYMPOSIUM

Jane C. Belcher
Professor of Biology

Challenged at the outset by the promise that thinking can be exhilarating, the participants in the symposium on Modern Science and Human Values quickly found and steadily maintained a heady mental pace on questions relevant not only to the symposium but to our period in history. What is science? Is there a difference between the scientist and the technologist? Is science humanistic? What are values? Are there values which are not human values? Is any value served through the discipline of science? Does "value" imply "moral value"? Is the scientist responsible for the use made of his discoveries? Do the scientist and non-scientist have basically different attitudes toward these problems? What is the scientist's role in society? How can the scientist or technologist resolve a conflict between the demands made on him as a citizen or a humanitarian and those made on him as a scientist?

These questions and others appeared and re-appeared during the informal as well as the more formal portions of the program, and as though by design soon became a framework supporting the body of the conference.

In opening the symposium, President Pannell set the topic in an historical perspective by inviting an examination of man's cherished traditions and his concept of the future in the dramatic light of Sputnik, symbol of recent technological advance. She greeted Everett W. Hall, Kenan Professor of Philosophy at the University of North Carolina, who introduced the symposium, and served throughout as coordinator.

Professor Hall brought into clear focus one of our great modern dilemmas: how can the interests of science and of a peaceful society both be served? He pointed out that although the pursuit of science demands characteristics of high moral order in the scientist, and science attempts to reveal truth, which is generally conceded to have value, still science is by its nature amoral, unable to verify or disverify moral value; and yet the products of science may demand moral judgment, since they may be exploited for peaceful or destructive purposes. One of the roots of the dilemma is that the scientist's only obligation to science is to seek the truth; he is not required to consider the applica-

Professor Hall, symposium coordinator; Dr. Miriam Bennett and Dr. Florence McCulloch, co-chairmen of the symposium.

tions of the truths he reveals. The non-scientist, on the other hand, while able to understand some of the products of science, is not bound by any obligation to science; he is motivated by a desire to apply scientific principles to the solution of practical problems. All of this being true, who is to take the responsibility for scientific principles when they may be used to produce instruments of destruction?

Professor Hall stated that he believed one of his functions in the symposium would be to emphasize the limitations of science, in order to counteract the glamour cast on it by recent events. He admitted, however, in introducing Professor Helen Dodson Prince, astronomer at the University of Michigan, that her topic, *The International Geophysical Year—A Great Human Adventure*, would be concerned with a scientific program representing one of the greatest cooperative efforts in history, which serves to illustrate not the limitations of science, but the way in which science obliterates national boundaries in solving its problems.

Professor Prince's address, printed in full in this bulletin, made vividly clear the essence of scientific inquiry, the thirst for knowledge for its own sake, particularly as she described her own work on solar phenomena. But beyond this she gave an eloquent testament of faith in IGY, not only as a scientific program but as a living proof that nations *can* cooperate. Her closing observation, that the "desire to know for the sake of knowing" may yet prove to be the route leading

to international understanding and a realization of the brotherhood of man, must have been at least in part responsible for the spirit which characterized the rest of the symposium.

The next day Mrs. Finn Ronne, speaking on *The Antarctic Phase of the International Geophysical Year*, provided examples of Mrs. Prince's claim that today's Christopher Columbus would undoubtedly be located in some inaccessible, lonely part of the globe, collecting data for IGY. Mrs. Ronne was well qualified to speak on IGY in Antarctica, since her husband headed the Ellsworth IGY Station, she had been editing the news from this station, and she herself had spent a year in Antarctica with her husband in 1947-48.

By describing some of the United States' Antarctic program, she gave the audience a sense of the vast amount of planning and effort necessary on the part of the sixty-seven cooperating nations to fulfill their commitments for IGY. But along with her view of the scope of the program she also provided a clear glimpse of the individual man, the scientist, the "modern Columbus," collecting data on weather, gravity, the earth's crust, or the ionosophere, and at the same time coping with cold, wind, the ice and the white-outs, the long night, and penguins. She even described some of the drama associated with the initial discovery and gradual opening up of the continent of Antarctica, an exciting history brought up to date with the story of the "great onslaught," with men of many nations invading the frozen continent in the service of IGY.

Professor Henry Guerlac of Cornell University, taking good advantage of his background in science and history of science, spoke on *Science as a Humanistic Discipline*. His thesis, briefly, was that the justification for scientific study in earlier historical periods was humanistic, and that only recently has it become materialistic. He asserted that both science and society will be better served when it returns to a humanistic base.

In his exposition, Professor Guerlac contended that in Galileo's day the defense of the study of nature rested on its valuable role in demonstrating truth, in overthrowing errors, and in dispelling confusion. Later, from the seventeenth to the mid-nineteenth century, the argument was that the study of nature served to uncover the "Grand Design," and thus was necessary for an understanding of "God's Creations." The publication in 1859 of Darwin's *The Origin of Species* and the sudden rise of technology resulted in the eclipse of this argument by one which has dominated our contemporary period. The twentieth century has been an era of applied science, of technological applications of scientific principles, with less and less emphasis on the intellectual and cultural role of science, more and more on its utilitarian value.

Unless the scientist of the future is to become a technician and skilled robot, Professor Guerlac believes, he must return to the values and aspirations of an earlier period, reinterpreting them in the light of modern problems. His warning to scientist and layman alike was, "If we are to live with science and defend it, we must seek higher ground than the utilitarian."

A persuasive argument for science—or the applications of science—and one consistent with Professor Guerlac's hopes for the future, was presented by W. Albert Noyes, Jr., Professor of Chemistry and Acting Dean of the College of Arts and Sciences at the University of Rochester, in his discussion of *Science on the International Scene*. He pointed out that because of certain generic characteristics, science is uniquely qualified to contribute to international understanding. Communication in science is by means of a language which is international, having evolved within an intellectual discipline rather than within a national or geographical area. The process of communicating in science is also international, for scientists are in touch with each other through their publications and their periodic conferences. A third feature, almost too obvious to need mention, is that the products of applied science are daily in greater demand over the globe.

Dean Noyes demonstrated that the ability of scientists to cooperate on an international basis is being put to good use in such United Nations agencies as FAO, WHO, UNESCO, and others, and also by nations in implementing their foreign policy. In particular reference to United States' foreign policy, he reminded the audience that not only in the production of weapons but also in aid to underdeveloped countries, aid to our allies, investment of United States capital in foreign projects, and and in other ways, the international cooperation of scientists has become a valued ingredient. Dean Noyes' advice for the future was to keep the best scientific intellects, the Curies and the Einsteins, in the laboratories, but to train others for their share of international service, training them not only in science but in all areas which would help to make them good ambassadors. He also provided an effective answer to a question posed earlier by Professor Hall. How does the scientist avoid schizophrenia when he uses his talents to serve his country in its military program? Dean Noyes pointed out that any man can recognize differences in political ideas and can support the political philosophy he likes, either when this support involves helping to prevent war, or helping his country to win a war.

Professor Jacques Rappaport, consultant; Professor Prince; Kenan Myers, student chairman; President Pannell.

A biologist's view of value in nature as it has proven itself in evolution was presented by Professor George Wald of Harvard University, speaking on *Ways of Beasts and Men—The Evolution of Behavior.* As a springboard for his discussion, he used Herbert Spencer's concept of the application of the theory of natural selection of human social evolution—that natural selection operates in the evolution of society and will continue to operate until a highly ethical species has evolved from *Homo sapiens.*

Professor Wald made no attempt to discredit or defend this idea, but he did propose that natural selection is as effective in the evolution of behavior as in the evolution of anatomical features, and that it will tend to preserve any heritable variant of behavior which has value for the species. This conclusion, he believed, was supported by studies on rats with polyneuritis resulting from a diet deficient in thiamin: the rats' hunger seemed to drive them to ceaseless activity which finally ended in death. Such behavior, as Professor Wald pointed out, violating as it does any "law" of self-preservation, is at first glance inconsistent with the tenets of natural selection. Further study, however, suggests that the behavior leading to the death of affected individuals would benefit the species by trimming a population to a size compatible with the food supply. As a comparable example, he suggested that the migration of lemmings into the sea perhaps represented a hunger

migration, benefiting the survivors and thus the species. He further cited examples of elaborate patterns of behavior characteristic of other species, including the migration of the eel and the system of communication among bees so beautifully analyzed by von Frisch, and he showed in each instance how the pattern of behavior had selective value within the species. In concluding his talk, he invited his listeners to draw their own parallels between human and animal behavior, and to consider the evolutionary implications.

The more formal addresses of Thursday and Friday were followed by an informal panel discussion Saturday morning in which Professors Prince, Noyes, Guerlac, and Wald discussed questions presented by members of the audience or by the chairman, Professor Hall. The questions and comments fell into two general groups, one concerning the scientist as a citizen and science as an instrument of war, the other concerning the more abstract issue of *value* in connection with science.

Considering the scientist-citizen, there was general agreement that scientists exhibit the whole spectrum in politics, although they perhaps show a wider left-of-center band than is found among the general public. It was conceded that the scientist has no special formula for solving international political problems unless use can be found for his formula which has been so effective in solving international scientific problems. In answer to the suggestion that science profits from war, it was pointed out that this is true of only a few branches and these largely in the area of applied science, and that war is a calamity for most branches of science. It was admitted, however, that the scientist is an opportunist, who will take advantage of technology to help him in his investigation, or will welcome government assistance in an investigation too vast or too expensive to be supported by private means. One panelist stated that one could defend the argument that the layman is as responsible as the scientist for the technological application of scientific principles in peace and in war, but acknowledged that the scientist assumes a special responsibility to society when he acquires special knowledge, just as the physician, true to the spirit of the Hippocratic Oath, declares a special responsibility to society in the use of his knowledge.

In considering the problem of values, there seemed to be agreement among the panelists that "the enterprise of being a scientist involves an acceptance of a series of values," in Professor Wald's words, that truth and knowledge have high value, that knowledge of science is good, since it provides man with knowledge of nature and his place

in nature, and, as Professor Hall remarked, a sort of religious morality may grow from a faith in truth for truth's sake. No answer came to his question, "Is science amoral?", unless one was implied by what seemed to be endorsement of his statement that it is not part of the content of science to demonstrate morality.

In performing his difficult task of summarizing the symposium, Professor Hall concluded that the discussions had demonstrated a real relationship between science and human values. Although, as he remarked, it had not been emphasized in discussion, the practical value of scientific work cannot be overlooked. Even more important, he seemed to think, was the effect which the pursuit of science had on its practitioners, challenging them to adventure, providing them with opportunities for international cooperation, and strengthening in them the traits essential to scientific work. Knowledge is a value in its own right, Professor Hall asserted. In conclusion, he said that as far as he could determine, no evidence had arisen contradicting his early contention that science cannot establish or overthrow judgments of value and that therefore science is amoral.

In this final session, Dean Pearl served as spokesman for the college in thanking the speakers for giving so much of themselves to the symposium, and she called attention to a truth demonstrated in the discussions, that the scientist is, after all, human, with human feelings, strengths, failings; the responsibility for the use of science rests not just on the scientists but on us all.

Mrs. Ronne brought first-hand information about the IGY program in Antarctica.

The Symposium

An Intellectual Challenge

ELIZABETH JOHNSTON, '59

Many students found the symposium on MODERN SCIENCE AND HUMAN VALUES the most challenging intellectual experience of their college years, both for the knowledge gained in many areas of science and for a new understanding of science and its place in the world today. We will not lose the enthusiasm of the IGY and its many projects given us by our excellent speakers, and we will continue to discuss in midnight conversations the many questions they raised.

For many of us, particularly those majoring in philosophy, literature, or history, the most pressing problem is this: "What place must science have in my life?" Dean Noyes placed a tremendous responsibility on us when he said that in the twentieth century a student of the humanities with no knowledge of science is as out of date as a student of science without a background in the humanities. He jolted us by adding that the former is probably much more common than the latter.

As a result of the symposium, many of us feel that whether or not we learn a great deal about one branch of science, we must try to

Professor Guerlac's talk inspired many questions.

understand and appreciate the methods and goals of the scientist; perhaps, as Professor Guerlac suggested, by studying the history of science and by reading what great scientists of the past have written about their work.

Hearing about the varied projects of the IGY, we were particularly conscious of the increasingly specialized nature of science. Professor Prince raised the question, "Are we moving toward a priesthood of scientists, men and women who can communicate only with each other?" If the answer is yes, do we not have an even greater responsibility to become better informed, in an effort to halt such a movement?

Professor Prince, Mrs. Ronne, and Dean Noyes stressed the importance of science in international politics, suggesting that the IGY might be a firm foundation for future cooperation among the nations of the world. However, they also made us aware of the difficulties of international scientific exchange: How much information should a scientist give another country, even an ally of the United States? Should an astronomer from Red China be allowed to attend a scientific meeting in America? Should an American scientist meet with communists working on similar projects? Dean Noyes indicated that questions such as these may create world crises in the near future. To deal with these problems a new career is evolving, that of the scientific statesman, who must understand not only science and the scientist, but the complexities of international law and politics as well.

Professor Wald directed us toward interesting speculations about the uniqueness of man's nature in his discussion of the evolution of behavior. The apparently self-sacrificing lemmings go and drown themselves and, as a result, the rest of their clan will have enough to eat. Bees can convey explicit directions with a simple dance, which can now be interpreted by biologists as well as by bees.

The most provocative questions were those dealing with the relation of science and human values. Is science a moral or an amoral force? Should it be considered a search for truth or for useful information? Does the scientist as a member of society have a moral responsibility for his discoveries?

In his sermon Sunday morning, Dr. Langmead Casserley asserted that we cannot separate science and values, that science is itself one of the highest human values, and it is a means of entering into a relationship with God.

One of the most exciting results of the symposium was the discovery that these eminent scientists were also delightful individuals. We appreciate the thoughtful planning which made it possible for students to talk informally to the speakers and visiting professors and specialists who served as consultants. We also enjoyed having visual records of some of the programs described by the speakers, through the films of solar phenomena and the Antarctic. In addition, there were the amazing photographs of "The Anatomy of Nature" — trees, shells, insects, rocks, and earth formations — on exhibit in the library.

Dean Noyes and students.

It is difficult to say what meant most to us; we learned many facts and acquired many new ideas, but perhaps we will remember longest the feeling of closeness among all those participating, the excitement of having everyone striving together in an attempt to gain a better understanding of the relationship of modern science and human values and their relevance to our own lives.

Saturday's panel: Professor Wald, Professor Guerlac, Dean Noyes, Professor Prince, Professor Hall, moderator.

The Symposium

A Student Experience

Susan Hunt Davis, '58

Unanimous among the students who were fortunate enough to be able to attend the symposium on Modern Science and Human Values was their expression of gratitude: not only for the excellent choice of speakers and consultants but also for the year of hard work by the committee of faculty and students which was necessary for an undertaking such as this.

During and following the three days of the symposium, I heard other and somewhat varied feelings expressed. They included enthusiasm, wonder and excitement, intellectual stimulation, sheer enjoyment, and finally mental exhaustion from the high pitch which had been maintained throughout this time.

Earlier in the year, many students who are not science majors were somewhat dismayed when they heard the theme of the symposium, and probably the most common pre-symposium comment was, "But I don't know anything about science." Those who attended in order to learn made the most common post-symposium comments, "I actually understood every word he said," and "I didn't know science could be so fascinating."

These comments in themselves testify to the success of the symposium and illustrate its most outstanding features: its general interest, its clarity, and the ability of the scientist-speakers to communicate with a predominately lay audience.

At the very beginning, the symposium established an atmosphere of inquiry as well as that of assimilation. In their opening remarks, both President Pannell and Professor Hall posed the question which was to occupy our thoughts for the entire three days: What is the relation of modern science to our lives, interests, and values? This question was

treated by all of the speakers, each from the point of view of his or her work, and the answer became self-evident. In addition, this question was considered in the question periods which followed some of the addresses, in the student-led discussion groups, by the panelists, and possibly most of all at the informal coffee hours.

This spirit of inquiry seemed to grow as the days passed. The students who had always considered science as something foreign were suddenly finding themselves exposed to enormously fascinating and new ideas which left them with endless, excited questions. This, to me, was one of the finest accomplishments of the symposium—the stimulation of student interest in a subject which is an integral part of our lives today.

This great enthusiasm and stimulation was engendered for the most part by the inspiring speakers. These men and women dispelled all thoughts that scientists are cold and unintelligible beings, for they were warm, down-to-earth, very human people. The many opportunities we had to chat informally with the speakers were among the most delightful aspects of the entire three days.

It is safe to say that every student who attended these sessions came away with new ideas about science and its place in our world today. For some, it was the discovery that science is not only a practical discipline but a wonderful human adventure. For others, whose interest was already focused upon science, this symposium was an added stimulus toward their goal and it was a broadening experience which illuminated all the great potential of science—political, humanistic, and practical.

Student discussion group in the Browsing Room, with Miss Thyllis Williams, consultant.

The International Geophysical Year — a Great Human Adventure.

Helen Dodson Prince
Professor of Astronomy
McMath-Hulbert Observatory, University of Michigan

The title of our symposium — Modern Science and Human Values — puts before us a subject that lends itself to many different interpretations and invites various avenues of approach. From one angle we can assert that science, per se, has nothing to do with values. The factual data comprising the subject matter of science is essentially "value free." If we wish to emphasize this point of view, we can argue that we should not attempt to bring into juxtaposition the two concepts, Science and Human Values, and our symposium should close before it begins!

On the other hand, the word "science" can be interpreted in a much broader sense. It has come to mean the whole gamut of things associated with the pursuit of information by the scientific method. Those of us who have lived in the United States during the closing months of 1957 and in early 1958 know full well that science, in its broader meaning, has burst the bounds of the laboratory and is now firmly established in the sphere where things "matter," in the sphere of values. Indeed at the present time, science may be very close to the center of that sphere.

It is fortunate, I believe, that the very moment in history in which we have become so mindful of the importance of science as a way to many things—some good, some bad—coincides exactly with the time of the most far reaching, cooperative scientific program ever undertaken by mankind. I refer, of course, to the International Geophysical Year, the so-called "IGY," a program conceived in the spirit of really wanting to know more than ever before about the physics of the earth as a whole, about the earth as a planet, as an object in cosmic space—and wanting to know just for the sake of knowing. That there are political implications to certain aspects of the IGY program (especially the satellite project) we all know. Nevertheless, for most of us who are participating in the IGY these are implications far removed from the motivations and spirit of the basic program of the IGY. For us, the IGY is an opportunity to learn more about the earth on which

we live—just because we want to know. It is a project so far reaching in its vision and vast in its scope that it is indeed one of the great human adventures of modern times.

What is the International Geophysical Year? We must realize first that it is a program, not a unit of time. The active phase of the program began in July 1957 and it is to continue for eighteen months until January 1959.

The IGY is a program designed to increase man's knowledge of geophysics. Geophysics is the science of the physical properties of the earth as a whole: the inside, the surface, and the far reaching outer atmosphere. In the study of geophysics one must always be mindful of what is happening on the sun, because events on the sun greatly influence certain of the physical properties of the earth. Thus during the IGY, the earth is being studied as a whole, and with respect to its cosmic environment.

Although the vastness of the project, the almost audacious attempt to study the entire earth, marks the IGY as a thoroughly modern undertaking, the questions that it seeks to answer are probably as old as man himself. Throughout the ages man has never ceased to ask "where," "what," and "why" of the earth on which he finds himself. These questions are basically questions in geophysics. Progress in answering them has been closely associated with the emergence of our culture from superstition to what we somewhat presumptuously call "understanding." From rain gods to meteorology is perhaps a long stride in the course of man's civilization, but the well known difficulties of the local weatherman make us realize how far we are, even today, from understanding our gross natural environment on the earth.

In a shorter time scale, the International Geophysical Year now in progress is not the first cooperative effort to study geophysics. It has had two immediate predecessors. The first was the International Polar Year in 1882 when the scientists of a small number of nations cooperated in an effort to extend to the far arctic regions systematic observations of the weather, the earth's magnetic field, and the aurora borealis. After a lapse of fifty years, a Second International Polar Year was undertaken in 1932. At this time study of the ionosphere, the high, electrified upper part of the earth's atmosphere, was included in the program. Both of these undertakings were called Polar Years because the programs were primarily efforts to extend to the uninhabited, and therefore "unstudied," polar regions of the earth, the kinds of measurements already being made in the inhabited areas.

Now, twenty-five years later, the same basic efforts and purposes are present in the third undertaking in the series. However, the current International Geophysical Year surpasses in scope, intensity and geographical coverage the two earlier programs. Observations are being made from the Antarctic as well as from the Arctic regions. There are stations covering all the major land and sea masses of the earth. Observations are being made from far above the surface by rocket and satellite as well as from the surface. Never before has such a world-wide study been undertaken by man. It is exciting in its challenge; it is promising in its results.

At the present time more than 10,000 scientists from sixty-seven nations are actively participating in the IGY program. The cooperating nations range all the way from the great world powers, the United States and the Soviet Union, to the tiny Vatican State, to nations like India with internal problems of impoverished populations, to countries such as those of South America which are relatively inexperienced in large-scale scientific programs.

The task of organizing this sprawling, earth-encircling program was unbelievably complex. It required years of preparation and much give-and-take between national committees. But the program began on schedule July 1, 1957! If you have ever attempted to do so simple a thing as secure committee agreement on when and how to hold a party you can begin to appreciate the difficulties encountered in seeking agreement among all the participating nations on the way to observe, record, and report the many phenomena that are being studied.

In spite of all the difficulties, in spite of the universal desire to "do things your own way," the IGY is in full swing. Almost all of the nations of the world are actually doing something together.

The programs of the IGY fall into ten separate academic disciplines. Six of these are concerned with relatively familiar fields of study.

Oceanography — Special emphasis is being laid on study of ocean currents.

Glaciology — Are glaciers increasing or decreasing, and how much?

Latitude and longitude — Positions on any one land mass are known, or can be determined, with great accuracy, but this is not true for places in different continents. This information is necessary if we really want to know if the continents are "drifting," as is sometimes thought.

Gravity — Its variations from place to place will help to determine the exact shape of the earth more exactly.

Seismology — Studies of earthquakes in polar regions should augment present information about the inside of the earth.

Meteorology — IGY studies of the weather will make it possible to prepare, for the first time, weather maps for the entire earth comparable to the familiar daily weather maps of small regions.

There are four less familiar disciplines:

Cosmic rays — These most energetic of all particles are constantly entering the earth's atmosphere from outer space. They vary in frequency and intensity from day to day and from place to place on the earth. Sometimes events on the sun cause great increases in their abundance.

Ionospheric physics — The high, electrically charged layer of the earth's atmosphere is called the ionosphere. The ionosphere acts as a mirror and reflects certain radio waves back to the earth, thus permitting reception of radio signals from distant stations. The height and reflectivity of the ionosphere are very sensitive to changes in the amount of ultraviolet radiation from the sun, and these changes are being studied in great detail.

The aurorae or "northern lights" — Particles from the sun bombard the earth's atmosphere and cause it to shine with a light of its own. Progress is slow in efforts to understand the nature and causation of the aurora borealis and australis and the program of the IGY should greatly extend knowledge in this field.

Geomagnetism — Study of variations in the earth's magnetic field constitute one of the most important of the IGY programs. Great variations, indicated by oscillations in the pointing of a sensitive compass needle, occur from time to time and are called geomagnetic storms. It is at the time of geomagnetic storms that the aurora borealis is visible.

In addition to the foregoing, there are two general programs that apply to all or many of the ten separate disciplines of the IGY. They are the satellite program and the world-wide system of solar observations.

The satellite program makes it possible to extend and improve information heretofore attempted through balloon and rocket experiments. Observations from satellites are of unique significance when very great altitudes are needed, or when high altitude observations must extend through long periods of time or include earth-wide geographical

coverage. It has been said that a satellite is a "long playing rocket"! Information from satellites will assist in studies of the height and density of the earth's atmosphere, the shape of the earth, short-wave radiation from the sun, and the density of particles and cosmic rays in interplanetary space.

The solar program is the most "astronomical" of the IGY programs. The sun is a star, and in many ways an average star. It appears large and bright only because it is relatively close to the earth. Because the sun is so close, it determines the basic cosmic environment of the earth.

The sun undergoes many changes. Some of the changes must be measured in units of years, but others take place from day to day, hour to hour, and even minute to minute. The principal long period variation in the sun is the so-called eleven-year sunspot cycle. This cycle refers to the change in the number of sun spots visible on the solar disk.

The time of the International Geophysical Year was chosen (some six or more years ago) to coincide with what was expected to be the maximum in the present cycle of solar activity — the time of the greatest number of sun spots. Only time can tell how good (or bad) was this prediction. It is possible that the maximum may have been passed just before the start of the IGY.

A sun spot is an indication of a "storm" or disturbance on the surface of the sun. When there are many spots on the sun there are also other manifestations of solar activity or disturbance. Certain types of solar activity go through their changes very quickly, and it is usually the rapidly changing solar phenomena that have the greatest effects on the earth. Consequently, it is with the transient solar features that the IGY is most concerned. Many of these features change so rapidly, that it has been necessary to apply the techniques of motion picture photography, in order to record their complete development.

Solar studies for the IGY have a dual purpose; first, to warn IGY observers in other fields of the times when, as a result of "events" on the sun, there is increased probability of special geophysical effects or disturbances; secondly, to acquire a vast body of physical measurements of solar phenomena in the hope that current and future studies of the data will yield improved understanding of the physics of the sun and of the complex relationships between the sun and the earth.

In order to carry out these purposes the sun must be under observation at all times. Round-the-clock observation of the sun demands close cooperation of solar observers all over the world. It is not possible

for solar observers in any one part of the earth to observe the sun at all times. No matter how diligent and no matter how free from vagaries of the weather they may be, they still must accept the fact that the sun sets. It is then that those who observe from distant longitudes must be depended upon to provide the needed data. Thus, those who study solar activity have a built-in tendency to cooperate with solar observers in other lands, and the history of solar studies shows a long and fine record of international cooperation in these matters.

Certain solar phenomena change at such relatively slow rates that IGY needs can be met by observations once an hour, or at only a small number of times each day. Sunspots, their encompassing bright "plages," and the great outer atmosphere of the sun, the corona, fall into this category. More rapidly changing features — flares, prominences, and radio-frequency emission — require as nearly continuous observation as possible, through records that show changes from minute to minute, or even second to second.

Most of the long established solar observatories in all parts of the world are participating in one aspect or another of the vast IGY observing program. In addition, a small number of special "IGY solar stations" have been established to provide data from those regions of the earth not already covered by existing observatories. The longitudes dominated by the Pacific Ocean constituted one such area, and a new solar station in Hawaii now fills the gap.

The regular, almost routine solar observations provided by the above patrol programs are supplemented by a large number of special observations, carried out whenever possible, and whenever solar circumstances seem especially advantageous. Many of the special observations are concerned with a determination of the magnitude and variation of short-wave radiation from the sun — cosmic rays, far ultra-violet light, and x-radiation that cannot penetrate to the base of the earth's atmosphere where the "grounded" solar astronomer keeps his telescope. Consequently, many of the very special IGY solar observations must be made from rockets and satellites far above the dense layers of the earth's atmosphere. In addition, "ground based" solar observatories are using certain of their newest and best instruments to record spectrographic studies of flares and the distribution of solar magnetic fields and thus provide information not otherwise obtainable. By the close of the IGY in December 1958, the sun will have produced so many "events" and fine solar instruments will have recorded so many data, that the solar astronomers cannot fail to have

learned much that is new about the earth and its cosmic environment. Nevertheless, the chances are good that the same solar astronomers will continue to be baffled for years to come by the intricacies and complexities of the earth's nearest, and sometimes very disturbing, stellar neighbor.

I have tried to outline for you the history, the purpose, and the program of the International Geophysical Year. We are now midway in this Great Adventure. There has already been an increase in what can be called straightforward, factual information. For example, we now know, by studies from both rocket and satellite, that the earth's atmosphere is much more extensive than previous studies had indicated. In some respects it tends to merge with the fringes of the great outermost atmosphere of the sun, the corona.

At this point, many of you may be thinking, "Fine — for those who want to know about this, — but does it have any meaning, or value, for me?" About this I cannot be sure, but I would like to try to translate it into different terms.

The spacial relationships of the earth and the sun were matters of such general concern a few centuries ago that in the history of ideas, the recognition of a sun-centered, rather than an earth-centered planetary system is referred to as a "revolution," the Copernican revolution. I do not wish to suggest that a comparable turning point in our thinking is now in progress, but there is indeed a change. If we take the new knowledge about the atmospheres of the earth and sun at face value, an important new idea is emerging. Considerable evidence now exists to indicate that, in certain respects, the high, upper atmosphere of the earth merges smoothly into the far-reaching outer "atmosphere" of the sun. In fact, the sun's "atmosphere" extends probably even beyond the orbit of the earth. Thus, in some respects, it might be said that our earth is actually inside the sun. We live not only on a planet in space but also inside a star. No wonder the sun affects the earth! And no wonder that the program of solar studies is one of the most important programs of the IGY.

Finally, important though the new scientific data acquired by the IGY may be, another aspect of the program may have far greater significance for all of us. The fact that a large number of scientists, from practically all of the nations of the world, really are carrying out a gigantic undertaking, primarily in a spirit of cooperation and good will, may be a real contribution to the understanding of the way the peoples of the earth can act and work together. As such, it may far transcend in significance the contribution of the IGY to the understanding of the planet on which we live.

If the IGY is indeed carried out in an overall spirit of cooperation there will always be a ray of hope for world peace. Even though the more usual, the apparently more rational modes of international cooperation should falter and fail, even though our diplomats, economists, and international experts should find the conference tables of the United Nations increasingly ineffective, there will always remain the fact that by thinking in new patterns and categories, by rallying around man's desire to know, even the most diverse national interests were put into second place for at least a short time. During the IGY all of the competitive, nationalistic desires and interests of the many nations continue to exist, and play their roles, and cause their confusions. But the IGY will have demonstrated that the uniquely human trait of curiosity, a desire to know and understand, can control and can hold in check the equally human traits of self interest and greed.

It is hard to predict who will be making the important policy decisions for our nation twenty-five years from now. Will it continue to be persons trained primarily in law, diplomacy, and government, or will, perhaps, more and more responsibility be given to those whose training has been centered on a search for knowledge—a training which finds it hard to recognize national boundaries and purely selfish interests.

It is possible that much of the hope for the future rests on the chance of international cooperation, successful because it is based on principles and motives that are different and perhaps more compelling than those we have called on in the past. If this should be the case, the IGY will have been much more than a vast international experiment to determine the physical nature of the earth. It may be the first audible sound of the twentieth century's effort to declare anew, and in terms of our modern era, the brotherhood of man, based on that trait that makes man different from all else — a thirst for knowledge, a desire to know just for the sake of knowing. The unclimbed mountain peak challenges man to climb it. In the same spirit, the quest for scientific knowledge can be high adventure for those who have the courage to seek it.

SCIENCE IS A VALUE

Dean Hosken
Associate Professor of Religion

According to Dr. Langmead Casserley, Professor of Dogmatic Theology at General Theological Seminary in New York City, the title of the symposium was misleading. When Dr. Casserley preached the sermon on the Sunday following the symposium, he affirmed that to say "modern science and human values" is to suggest that science itself is not a value, which in his opinion it most certainly is.

Dr. Casserley made clear to begin with a distinction between "real" and "secondary" values, defining real values as objective, grounded in the very nature of reality, while secondary values may be purely subjective. Real values are valuable to all men everywhere, while secondary values are "provincial." Finally, real values are intrinsic, while secondary values are instrumental.

"Science is a real value," Dr. Casserley claimed, "because science is a search for truth, and all truth has its basis in God."

Rejecting the Kantian theory that the mind itself creates the structure of what we know, and the theory of the Empiricists that the mind is simply a creation of the environment, Dr. Casserley reaffirmed the Augustinian position that the mind is created by God for the sake of knowing the truth, all of which has its ultimate source in the mind of God. For this reason Dr. Casserley sees no basic conflict between science and religion, another human value, since each provides a way of working toward truth and any working toward truth is a working toward God.

In the final analysis, Dr. Casserley concluded, it is in God that scientists and theologians alike "live and move and have their being."

Program

Thursday, March 6

8:30 p. m. Greeting: President Anne Gary Pannell
INTRODUCTION TO THE SYMPOSIUM
Everett W. Hall, Kenan Professor of Philosophy,
University of North Carolina. Symposium Coordinator.

THE INTERNATIONAL GEOPHYSICAL YEAR—A GREAT HUMAN ADVENTURE
Helen Dodson Prince, Professor of Astronomy,
University of Michigan

Friday, March 7

9:30 a. m. *SCIENCE AS A HUMANISTIC DISCIPLINE*
Henry Guerlac, Professor of the History of Science,
Cornell University

11:00 a. m. *SCIENCE ON THE INTERNATIONAL SCENE*
W. Albert Noyes, Jr., Professor of Chemistry and Acting Dean
College of Arts and Sciences, University of Rochester

2:00 p. m. *THE ANTARCTIC PHASE OF THE INTERNATIONAL GEOPHYSICAL YEAR*
Edith Ronne, editor of news from Ellsworth Station,
Antarctica, for the International Geophysical Year

3:30 p. m. STUDENT DISCUSSION GROUPS

5:00 p. m. Films: *Call of the Courageous*
Courtesy of Capt. and Mrs. Finn Ronne
Solar Activity
Courtesy of McMath-Hulbert Observatory; shown by Mrs. Prince

8:30 p. m. *WAYS OF BEASTS AND MEN—THE EVOLUTION OF BEHAVIOR*
George Wald, Professor of Biology, Harvard University

Saturday, March 8

9:30 a. m. Panel: *MODERN SCIENCE AND HUMAN VALUES*
Professors Prince, Noyes, Guerlac, and Wald
Moderator: Professor Hall

11:30 a. m. An Appreciation: Dean Mary J. Pearl
Symposium Summary: Professor Hall

Sunday, March 9

11:00 a. m. Service and Sermon: The Rev. J. V. Langmead Casserley
General Theological Seminary, New York

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